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PATENT

Attorney Reference Number 3382-53696
Application Number 09/432853

3. (Unchanged) The distributed computing network of claim 1 wherein the controlled computing device is an embedded computing device.

4. (Amended) A computer-readable medium having encoded thereon a state table representing an operational state of a remote computing device, the state table comprising: a plurality of entries, each entry comprising:

a variable identifier; and

a current value.

5. (Unchanged) The computer-readable medium of claim 4 wherein each entry of the state table further comprises:

a variable type;

a designation of legal values; and

a designation of a default value.

6. (Unchanged) The computer-readable medium of claim 5 wherein the variable type can include a data buffer containing a file, whereby transmission of the state table between devices effects transfer of the file.

-- 7. (New) In a distributed computing network having at least one controller computing device and a controlled computing device, the controller computing device communicating with the controlled computing device via a device control protocol to effect remote operational control of the controlled computing device, a method of maintaining data representing a current state of the controlled computing device at the controller computing device, the method comprising:

responsive to a controlled device state subscription request of the controller computing device per a subscription eventing model, distributing an initial controlled computing device state event having a predefined initial sequence number and data defining a present state of the controlled computing device to the controller computing device;

upon changes in the controlled device state, distributing controlled computing device state update events having sequence numbers assigned according to a sequential order following



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the predefined initial sequence number and data defining said changes to the controller computing device; and

in response to a renewed controlled device state subscription request, recommencing distributing the initial controlled computing device state event and controlled computing device state update events to the controller computing device so as to permit the controller computing device to reinitialize to the controlled computing device's present state upon failure to receive the controlled computing device state update events in sequential order of their assigned sequence numbers.

8. (New) The method of claim 7 wherein the predefined initial sequence number is zero.

9. (New) The method of claim 7 wherein the data in the initial controlled computing device state event is a complete state table defining the controlled computing device's present state, and the data in the controlled computing device state update events define updates in part of the state table.

10. (New) A controlled computing device operational in accordance with the method of claim 7.

11. (New) In a distributed computing network having at least one controller computing device and a controlled computing device, a method of maintaining data representing a current state of the controlled computing device at the controller computing device, the method comprising:

sending from the controller computing device a state subscription request conforming to a subscription eventing model by which the controlled computing device distributes sequentially numbered state events to subscribing devices commencing with an initial state event that conveys a full data representation of a state of the controlled computing device and continuing with state update events that convey partial updates of the controlled computing device state;

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upon receiving the initial state event, initializing storage at the controller computing device of a representation of the controlled computing device's state with the full data representation in the initial state event;

upon receiving state update events, updating the storage with the partial updates; and upon a failure to receive a state update event in accordance with their sequential numbering, repeating the actions of sending the state subscription request, initializing the storage and updating the storage.

12. (New) The method of claim 11 wherein the sequential numbering of the state events begins with a predefined initial sequence number.

13. (New) The method of claim 11 wherein the data representation of the controlled computing device's state is in the form of a state table.

14. (New) The method of claim 11 further comprising:
producing a user control interface display at the controller computing device based at least in part on the representation of the controlled computing device's state in the storage.

15. (New) The method of claim 11 further comprising:
sending from the controller computing device a control command for an operation of the controlled computing device depending at least in part on the representation of the controlled computing device's state in the storage.

16. (New) A controller computing device operational in accordance with the method of claim 11.

17. (New) A computer readable software carrying medium having computer software carried thereon for implementing a peer networking control protocol for a plurality of control point computing devices in a data communications network to effect control of a controlled computing device, the computer software comprising:

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a subscription registration program module operative when executed on the controlled computing device to in response to a subscription request of a control point computing device to register such device as a subscribing control point computing device to receive state events from the controlled computing device;

a state eventing program module operative when executed on the controlled computing device to distribute state events to the subscribing control point computing device, and further operative to assign sequence numbers to the state events in sequential order, the state events commencing with an initial state event having data for initializing a controlled computing device state table stored at the subscribing control point computing device to reflect a then present state of the controlled computing device, the state events continuing with state update events having data for updating the controlled computing device state table to reflect a changed state of the controlled computing device; and

the subscription registration program module further operative in response to a renewed subscription request of the subscribing control point device to cause the state eventing program module to recommence distributing a further sequence of initial state event and state update events to the subscribing control point computing device so as to permit the subscribing computing device to reinitialize its stored controlled computing device state table after failure to receive the state update events in sequence.

18. (New) A computer readable software carrying medium having computer software carried thereon for implementing a peer networking control protocol for a plurality of control point computing devices in a data communications network to effect control of a controlled computing device, the computer software comprising:

a state subscriber program module operative when executed on a control point computing device to communicate from the control point computing device a state subscription request conforming to a subscription eventing model of the peer networking control protocol by which the controlled computing device distributes sequentially numbered state events to subscribing devices commencing with an initial state event that conveys a full data representation of a state of the controlled computing device and continuing with state update events that convey partial updates of the controlled computing device state;

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a controlled device state storage initialization program module operative when executed on the control point computing device to in response to the initial state event to initialize storage at the control point computing device of a data structure representation of the controlled computing device's state according to the full data representation in the initial state event;

a controlled device state update program module operative when executed on the control point computing device to in response to the state update events to update the data structure representation in the storage according to the partial updates in the state update events; and

a sequence validation program module operative when executed on the control point computing device to detect a failure to receive any of the state events as per their sequential numbering, and operative upon detecting such failure to cause the state subscriber program module to communicate a renewal state subscription request from the control point computing device so as to re-commence distribution of sequentially numbered state events with a renewed initial state event from the controlled computing device in conformance with the subscription eventing model and thereby effect re-initialization of the data structure representation by the controlled device state storage initialization program module.

19. (New) The computer readable software carrying medium of claim 18 further comprising:

a user control interface display program module operative when executed on the control point computing device to display a user control interface display at the control point computing device based at least in part on the stored data structure representation of the controlled computing device's state.

20. (New) A peer networking state eventing and control protocol method for effecting state-concurrent multi-master control of a controlled computing device by a plurality of control point computing devices communicating on a data communications network, the method comprising:

from a plurality of the control point computing devices, receiving state eventing subscription requests;

responsive to the state eventing subscription requests, registering subscriptions of the respective control point computing devices to state events from the controlled computing device;



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communicating state events having information descriptive of a state of the controlled computing device to the respective control point computing devices of the registered subscriptions;

receiving a control command from a control point computing device instructing the controlled computing device to perform a specified operation affecting the state of the controlled computing device;

responsive to the control command, performing the specified operation; and

communicating further state events having information descriptive of the state of the controlled computing device after the specified operation is performed to the respective control point computing devices of the registered subscriptions, whereby the plurality of control point computing devices having registered subscriptions can maintain concurrent storage of data representing the state of the controlled computing device.

21. (New) The peer networking state eventing and control protocol method of claim 20 further comprising:

responsive to a state eventing subscription request of a control point computing device, communicating an initial state event having data defining a full data structure representation of the state of the controlled computing device upon registering the subscription of the control point computing device;

upon changes in the state of the controlled computing device, communicating state update events having data defining changes to the data structure representation of the state of the controlled computing device, wherein the initial state event and state update events have sequence numbers assigned in sequential order; and

in response to a renewed state eventing subscription request, repeating the communicating of initial state event and state update events, whereby the control point computing device can reinitialize storage of the data structure representation of the state of the controlled computing device after failure to receive the state update events in sequential order of their assigned sequence numbers.



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22. (New) The peer networking state eventing and control protocol method of claim 20 further comprising assigning the sequence number of the initial state event and state update events commencing with a predefined sequence number for the initial state event.

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